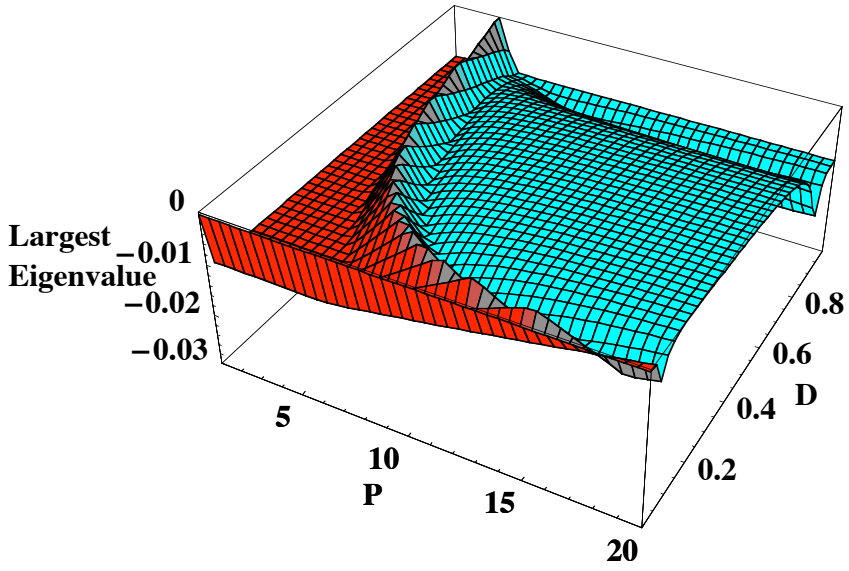
Stability Analysis (Jacobian)

The Jacobian for Eqs. **1-6** has the form:

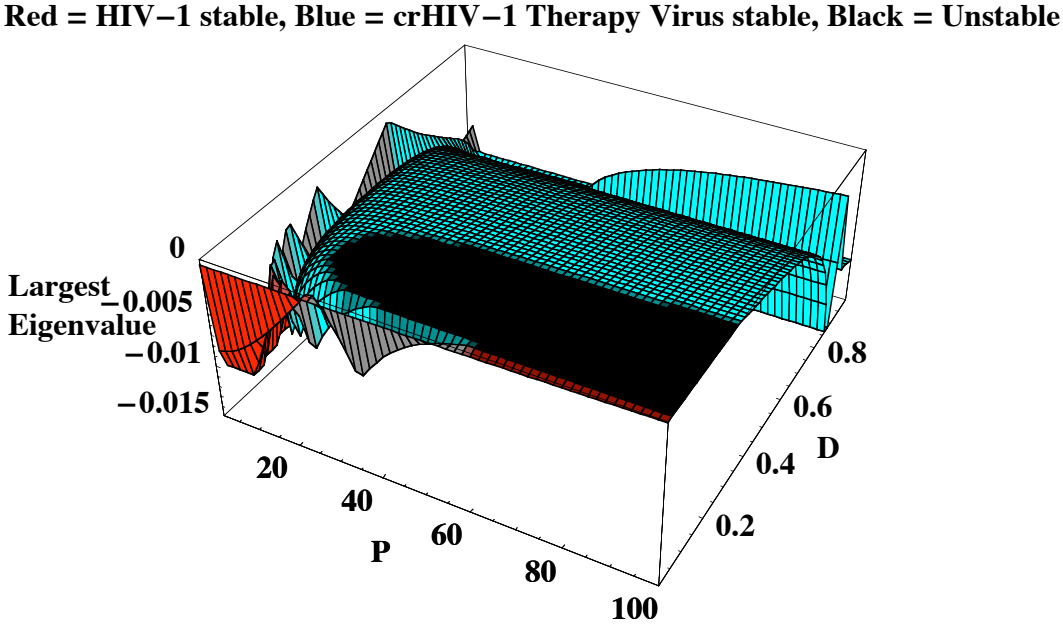
$$\begin{pmatrix} -d-\overline{V}\,k-\overline{V_T}\,k & 0 & -\overline{T}\,k & 0 & 0 & -\overline{T}\,k \\ \overline{V}\,k & -\delta & \overline{T}\,k & 0 & 0 & 0 \\ 0 & n\,\delta & -c & 0 & n\,\mathcal{D}\,\delta\,\delta' & 0 \\ \overline{V_T}\,k & 0 & -\overline{I_T}\,k & -d-\overline{V}\,k & 0 & \overline{T}\,k \\ 0 & 0 & \overline{I_T}\,k & \overline{V}\,k & -\delta\,\delta' & 0 \\ 0 & 0 & 0 & 0 & n\,\mathcal{D}\,\mathcal{P}^2\,\delta\,\delta' & -c \end{pmatrix}$$

where bar above the state variable denotes the steady state value for that state variable.
Below are graphs of the largest Eigenvalue of the Jacobian for the Basic Model steady state (i.e. only HIV-1 present) as well as the steady state when the crHIV-1 solution persists.

Red = HIV−1 stable, Blue = crHIV−1 Therapy Virus stable, Black = Unstable



If P is increased there is a Hopf bifurcation and a region of instability arises (black region):



A subregion of the plot ($D < 0.05$) explains the transitions between different stable regions and between stable and unstable regions:

Red = HIV−1 stable, Blue = crHIV−1 Therapy Virus stable, Black = Unstable